Electronics Stewardship at Brookhaven National Laboratory Keith Klaus, Donna King, Kathy Gurski, Anthony Guadagni, Ron Angona, Howard Hansen, Joseph Mead, George Goode

Used and obsolete electronics, such as computers, are part of a huge and complex waste stream that poses challenging environmental management problems. Electronic products contain a variety of hazardous constituents such as lead and cadmium. This ever increasing and changing waste stream presents challenges and responsibilities in all three phases of the Federal Electronics Challenge (FEC) electronics life cycle—acquisition and procurement, operation and maintenance, and end-of-life management. All three life cycles are addressed at Brookhaven National Laboratory (BNL). In addition to these three FEC life cycles, BNL's program is unique in that BNL's Instrumentation Division actually manufactures lead free printed circuit boards, thereby leading to a fourth phase, that is not addressed by the FEC—"design and manufacture".

The following details the status level of each life cycle based on the FEC award level criteria. BNL is actively addressing each lifecycle phase in order to achieve success in the FEC.

Acquisition and Procurement

The baseline status of this life cycle phase is currently at the FEC Bronze level. The CRT and LCD monitors which BNL purchases are energy star compliant. In an effort to enhance operational efficiency BNL has a procurement website with Dell Computers for procurement of personal computer systems. Currently the computers listed are EPEAT registered.

Operation and Maintenance

BNL is currently at the Silver level of the FEC award level for Operations and Management. Computer monitors are received with the sleep function enabled. All federal regulations and executive orders for electronic equipment related to energy efficiency are addressed. BNL has a requirement in its Standards Based Management System to power off non-essential computers while not in use. BNL actively promotes electronic stewardship and educates its staff through a variety of methods including newsletters, presentations and websites. Internally the reuse and recycling components are communicated in a variety of methods. Articles are published in the "Monday Memo", a biweekly email memo from the Laboratory Director to employees to communicate programs such as the Federal Electronics Challenge and the Federal Electronics Reuse and Recycling Campaign. Similar articles are published in "the Bulletin", the weekly Laboratory newspaper. Other publications include "Compliance Corner" which is focused on waste generators; and the ESH&Q monthly newsletter which is distributed to staff with ESH&Q responsibilities. Presentations focused on electronics recycling have been given to building managers and also to Environmental

Management Systems (EMS) representatives. BNL has an active website for electronics recycling, http://www.bnl.gov/esd/pollutionpreve/electronics/default.asp
BNL recently received a DOE award for participating in the FERRC, the Award was publicized in “the Bulletin” and on the recycling website.

Externally, the Community Educational Governmental Affairs (CEGPA) Office of Educational Programs (OEP) is responsible for executing the Computers for Learning (CFL) program, and is responsible for communications to the public. The CFL program through its outreach activities donated over 20 computer systems to two different schools during 2006 and anticipates building a wider network of schools for the donation of electronic equipment in the future.

BNL donated excess computer equipment to the Kid's Place Early Childhood Day School, for the purpose of improving the math and science education curricula. (March 23, 2006)

Computers segregated for Computers for Learning educational gifting program

End-of-Life Management

Based on the FEC award level criteria BNL is currently at the Silver level of the FEC for End of Life Management. BNL utilizes many programs for reuse of electronic equipment. The Laboratory itself is its greatest resource for reutilization. Annual transfers between various departments and divisions number range from 500 to 2,000 units. A great number of BNL's electronic assets are transferred from user to user until such time as an item reaches its life expectancy and is either too old or no longer working or repairable. The average life of electronic equipment is greater than 5 years before being retired. If assets are turned into Property Management in good condition, one of the following takes place: Item is placed in BNL pool for internal reuse.

1) ADPE (Automated Data Processing Equipment) is offered to the CFL Program. BNL donated over 20 computers systems and printers to local schools through the CFL program during 2006.

2) Items are entered into the EADS/GSAxcess excess database for screening throughout the country. The screening process is as follows:

- 15 days for DOE only screening
- After DOE screening if items are coded laboratory equipment, they are then automatically feed into the Energy Related Laboratory Equipment Program (ERLE) where they are offered to Universities for a 30 day period. (Universities must be registered to be part of this program). Transfers facilitated through this program must be approved through the area Operational Property Management Officer (OPMO).
- If assets are not claimed after DOE or ERLE screening, the items are then feed into the GSAxcess program for screening by other federal agencies for a 21 day period. During the last four days of this period, state and local governments can screen equipment, but cannot freeze items until the 21 day period is complete.

Computer servers recently screened on the GSA reuse site, currently being held for sale.

If items are not taken through the excess program, they are returned to BNL Property Management for disposition. The items are then offered for sale via internet through the Bid4assets program which is an ICPT contract.

If equipment is returned to Property Management in non-working condition, the working components such as memory, hard drives, video cards, sound cards, and CD/DVD drives are removed and retained for reuse on site by BNL staff.

Components for reuse

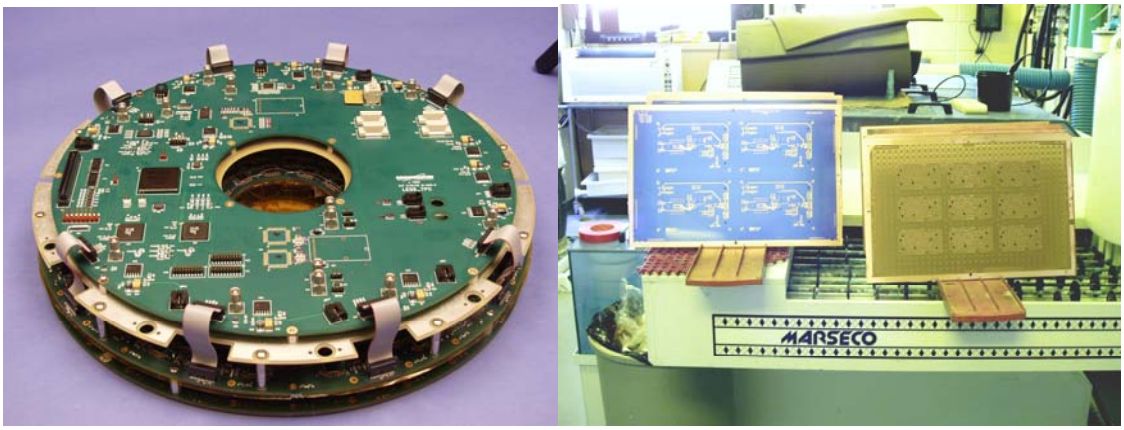
Recycling

Consistent with the EPA Waste Hierarchy, electronic equipment is sent out for recycling only as a last resort. All assets that are turned in to Property Management in scrap condition are sent to a contracted scrap dealer for recycling. BNL has recently shipped electronic equipment to UNICOR for recycling; plans to continue utilizing UNICOR exclusively are currently being evaluated. During the 2006 Federal Electronics Reuse and Recycling Challenge BNL recycled over 69,000 pounds of electronic equipment. During fiscal year 2006 BNL recycled over 123,000 pounds of electronic equipment.

Computers prepared for recycling, ready to be shipped

Design and Manufacture of lead free printed circuit boards

The Instrumentation Division (IO) at BNL operates a printed circuit board manufacturing facility (PC lab) in order to support research operations. The PC lab manufactures prototype and unique circuit boards for experiments and detectors at BNL and other global research centers. The PC lab uses a series of mechanical and chemical processes to fabricate these “environmentally friendly” circuit boards. Of particular importance is that the PC lab utilizes a process which minimizes hazardous waste and produces lead free printed circuit boards. This proactive manufacturing strategy is particularly important in order to comply with the Reduction of Hazardous Substances (RoHS) directive. In 1994 the PC lab redesigned their manufacturing process in order to remove lead from the finished circuit boards. Through process changes which entailed redesigning the electro-chemical plating baths, and substitution of tin anodes for the industry standard lead-tin anodes, the PC lab was able to produce printed circuit boards which contained no RCRA hazardous substances. The process change not only resulted in a reduction of hazardous waste production for the PC Lab, but resulted in circuit boards for scientists that contained no lead or other RCRA hazardous substances, eliminating a potential waste stream for the end user.



Examples of lead free circuit boards

Redesigned electro-chemical plating baths